

[54] **STEERING SHAFT, GEAR SHIFT LEVER SWITCH ASSEMBLY**

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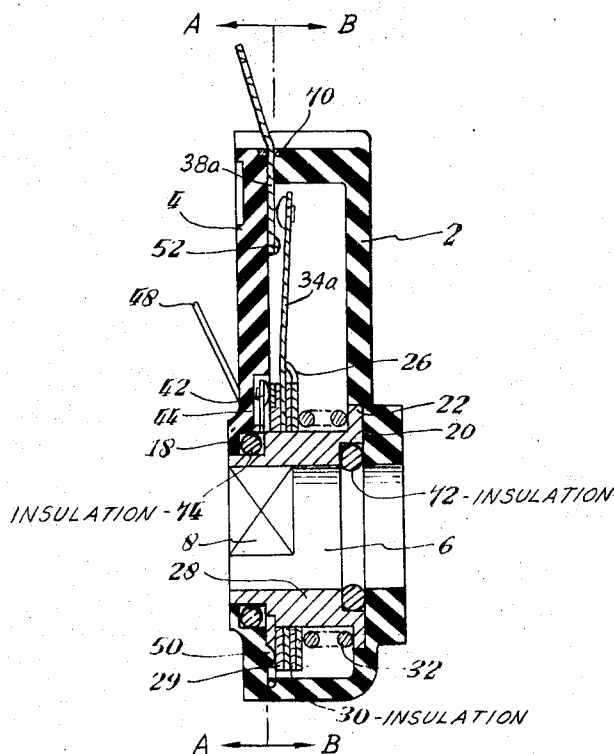
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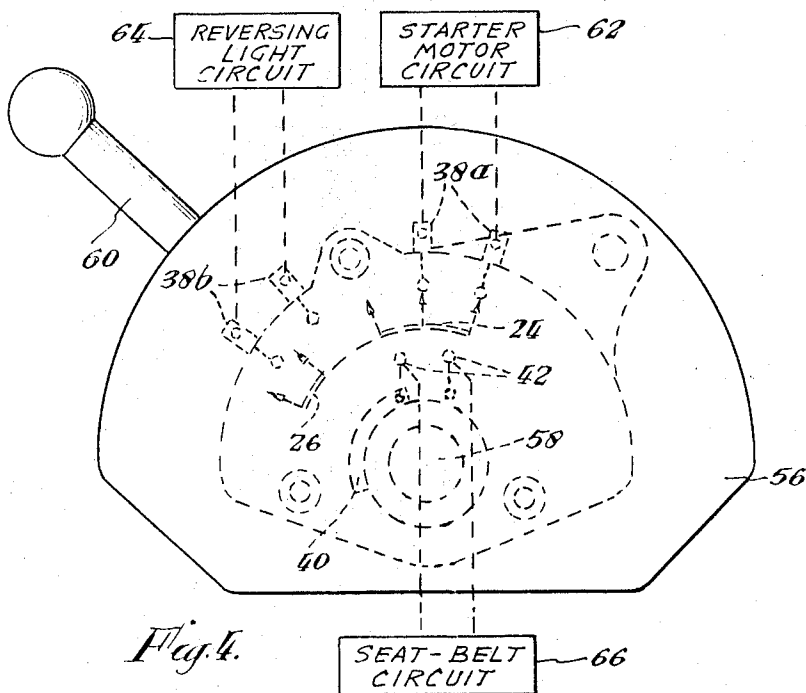
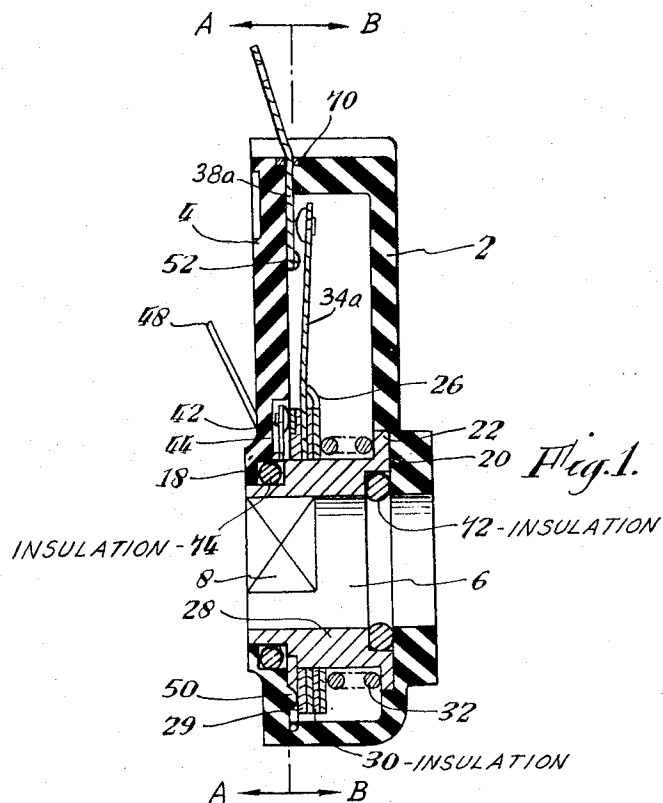
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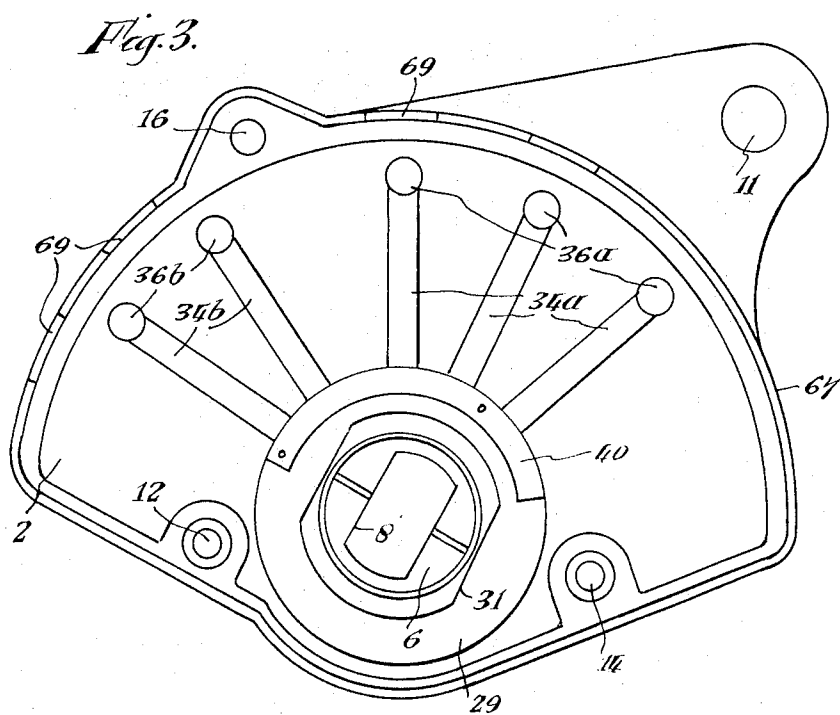
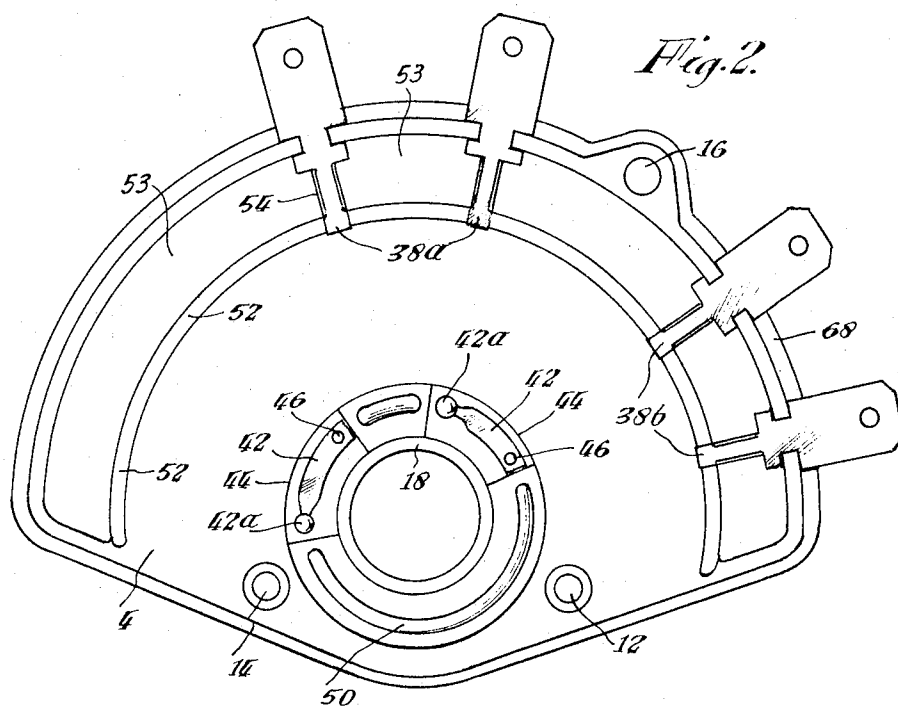
[57] ABSTRACT

A rotary switch arrangement may be associated with an automatic gear selector mechanism to inhibit operation of the engine starting circuit at certain positions of the mechanism and at other positions to operate reversing lights and a seat belt warning system. The switch arrangement comprises a plurality of rotary members urged axially towards fixed contact elements and having radial arms carrying contact buttons on their outer ends to engage said elements. The arms bear on a raised arcuate track when the contact buttons are out of registration with the contact elements, to hold the buttons in an air gap then.

8 Claims, 4 Drawing Figures







STEERING SHAFT, GEAR SHIFT LEVER SWITCH ASSEMBLY

This invention relates to electrical switches and is concerned more particularly with switches for use in conjunction with rotary mechanisms, such as in a vehicle automatic gear selector mechanism to give an electrical switching function in conjunction with the movement of such a mechanism.

An automatic gear selector mechanism is known which is provided with an ancillary electrical switching arrangement comprising a plurality of fixed contacts embedded in insulating material and a rigid moving contact arm carrying individual spring-loaded contacts that slide upon the insulating matrix into and out of engagement with the fixed contacts. This arrangement can only be used in a low power circuit and if it is to be used, for example, to control a starting motor circuit, it must do this through a relay with the result that the complete installation is complex and expensive.

According to the present invention, there is provided a switch assembly arranged to be operated by a rotary shaft comprising a plurality of contact elements and at least one switching member rotatable with the shaft, the member comprising contact means arranged to engage the contact elements at least at one predetermined angular position of the shaft to connect said elements electrically, resilient means arranged to provide contact pressure between the contact means of the member and the contact elements, and support means being provided for the switching member to hold the contact means in an air gap when out of engagement with the contact elements. The contact means of the switching member may comprise a plurality of contacts on respective resilient arms extending outwardly from the axis of said rotation, the, or a part of the support means acting on said arms.

Conveniently, the contact elements are arranged at spaced intervals adjacent the radially outer end of the switching member and said support means may comprise an arcuate track arranged to bear on a part of the switching member that is disposed radially inwardly of the contact means.

In another preferred feature of the invention, a coil spring acts as the resilient means at an inner annular region of the switching member, an inner support being provided for the member opposite the spring at an annular region radially outside the inner region but remote from the region of the contact elements.

In the application of the invention to a vehicle automatic gear selector mechanism, at least two contact elements may be associated with a starting circuit of the vehicle engine and the rotary shaft is associated with a selector lever of the mechanism, the switching member being arranged to permit operation of the starting circuit in a plurality of positions of the shaft lever by virtue of the member having alternative contact portions for connection of the plurality of contact elements at the different shaft positions.

Also, there may be at least two of said contact elements associated with a reversing light or lights on the vehicle, and the switching member may then be arranged to connect said elements when the rotary shaft is in the reverse gear selection position of the shaft and lever to permit operation of the reversing light then.

The invention will be more particularly described with reference to an embodiment adapted to be incorporated in a vehicle automatic gear-change arrange-

ment and shown in the accompanying drawings, wherein:

FIG. 1 is a transverse sectional view of a switch assembly according to the invention,

FIGS. 2 and 3 are views of the cover and body, respectively, of the assembly of FIG. 1, with their associated parts, in the directions A—A and B—B shown in FIG. 1, and

FIG. 4 illustrates schematically the arrangement of the switch assembly of FIGS. 1 to 3 in conjunction with associated elements of a vehicle having an automatic transmission system.

Referring to the drawings, the assembly comprises a moulded insulative case body 2 and cover 4. A collar 6 extends between aligned apertures in the body and cover and has a flat sided aperture 8 running through one end that received a complementary-form end of an operating shaft 58 projecting through bore 10 from the automatic gearbox selector unit S and forming part of an automatic gear selector mechanism, the casing being held together and mounted on the unit S using screws or rivets (not shown) through holes 11, 12, 14, 16 (see FIGS. 2 and 3).

The collar 6 has bearing engagements on a rim 18 of the aperture in the cover 4, through which it projects, and on an annular recess 20 in the case body 2, in which end flange 22 of the collar seats. The aperture 8 forms a keying connection whereby the collar rotates with the operating shaft.

Switching members 24, 26 of the assembly have ring-like inner regions by which they are mounted on a main, generally cylindrical part 28 of the collar 6 and they are separated by an electrically insulating washer 30 bearing on said ring-like regions. A supplementary ring-like switching member 29 is also mounted on the collar part 28 and bears directly on the ring-like inner region of the switching member 24. Internal tabs or flats 31 of the three members and of the washer fit slots or complementary flats in the collar main part 28 so that the members and the washer rotate with the collar. A coil spring 32 between the flange 22 and the member 26 holds the members 24, 26, 29 and the washer 30 together and urges them towards the cover 4 on which bearing tracks are provided for the switching members.

The members 24, 26 are of an electrically conductive material and have a series of radially extending contact fingers, there being three fingers 34a on the member 24 and two fingers 34b on the member 26, each finger terminating in a contact button 36a or 36b. The fingers 34b are cranked so that the outer ends of both groups of fingers are co-planar. Pairs of terminals 38a, 38b are mounted in closely fitting recesses in the cover 4 at spaced angular positions relative to the axis of the collar, for co-operation with the buttons 36a, 36b. The switching member 24 is associated with the terminals 38a and the angular spacing between each adjacent pair of its fingers 34a is the same as that of the terminals 38a. In two different angular positions of the collar and shaft, therefore, the two terminals 38a are simultaneously contacted by the bottoms of two of the fingers and are thus electrically connected by the member 24. Similarly, it is arranged that in another angular position of the collar and shaft the terminals 38b are connected electrically in the same manner by the switching member 16.

The third switching member 29 has its main body formed by an electrically insulating material but over

an arc of the face of the member adjacent the cover 4, an insert 40 of conductive material is adhered or moulded to the main body. Resilient contact arms 42 project from recesses 44 in the cover inner face to have contact buttons 42a projecting from the recess to be engageable with the arcuate insert 40. The arms 42 are secured in place by rivets 46 which pass through the cover and secure terminal tabs 48 to the external face of the cover for connection of the arms 42 to an external circuit.

By virtue of the insulating body of the member 29, the contact arms 42 are isolated from the switching members 24, 26. Also, the permitted movement of the shaft collar in relation to the terminals 38a, 38b is such that at no time can the fingers 34b connect the terminals 38a or any two of the fingers 34a connect the terminals 38b. Such a result in respect of said terminal elements can be achieved either by limiting the angular extent of movement of the collar and shaft or by providing different angular spacings between the terminal elements of each pair.

The cover 4 has an inner bearing track 50 divided into two parts by the recesses 44 and against which the assembly of switching members is urged by the spring 32. Also, a slightly higher, outer arcuate track 52 is provided on the cover, this being adjacent the inner ends of the terminals 38a, 38b and being interrupted by the recesses receiving the terminals. The fingers of the switching members 24, 26 bear on the track 52 when they are not engaged with the terminals and are thus held with their contact buttons spaced from recessed regions 53 on the inner surface of the cover. As is seen in FIG. 1, the terminals 38a, 38b are recessed below the level of the track 52 but to an extent less than the thickness of the contact buttons, so that as each finger coincides with a terminal the finger is lifted from the track with a degree of flexure and the force of flexure acts to urge the button firmly against the contacting terminal. In their region of contact with the buttons the terminals have chamfered side faces, as at 54, to allow the contact buttons to ride freely over them. The preloading of the switching members against the cam track and the terminals simplifies the manufacture of the switching members since then the need for flatness of the members is less important and a greater tolerance is acceptable in this respect.

As indicated in FIG. 4, the switch assembly is mounted on an automatic selector mechanism 56 with its collar 6 engaged by a shaft 58 on which selector lever 60 of the mechanism is secured so that the switching members are displaced relative to their associated terminals with pivoting of the selector lever. The lever is shown in an end location that is associated with the "park" position of the selector mechanism. In this state, the terminals 38a are connected by the switching member 24 so that the member provides an electrical link in starter circuit 62 of the vehicle engine thereby allowing the vehicle engine to be started.

Movement of the lever clockwise (as seen in FIG. 4) brings the selector mechanism next to the reverse drive condition. In this state, the terminals 38a are now no longer connected by the member 24 so that the engine cannot be started, while the terminals 38b are connected by the switching member 26, this making a reversing light circuit 64 so that the reversing lights of the vehicle are switched on automatically as the driver selects reverse movement. Further movement of the lever

60 disengages the member 26 from the terminals 38b and the lever next reaches the "neutral" position in which the member 24 again provides an electrical link between the terminals 38a of the starter motor circuit.

Pivoting the lever 60 beyond this position brings the selector mechanism into a plurality of drive positions at this stage, the contact 42 of seat belt circuit 66 are connected by the conductive insert 40 of the switching member 29 and warning and/or inhibiting means and/or operating means of the seat belt circuit will be actuated in any of the drive positions. The terminals 38a in the drive position of lever 16 will not be connected by the member 24 for reasons aforementioned, i.e., either the angular movement of the collar is limited or different angular spacings are provided between the terminal elements of each pair.

The casing body 2 has a peripheral rim 67 that seats firmly in a recess 68 at the edge of the cover. Interruptions 69 of the rim coincide with the terminal positions so that in conjunction with the recess 68 there is formed at each such position a recess 70 surrounding the terminal at the outer face of the casing. The interior of the casing is sealed from the exterior by the body and cover being joined together by an adhesive seal and the sealing compound also fills the recesses 70. On the collar there are inner and outer insulative O-rings 72, 74, the outer ring forming a seal between the collar and the cover 4 and the inner ring forming a seal between the collar and the shaft.

The combined effect of the adhesive seal and the O-rings is that there is no opportunity for foreign matter to enter the casing from the exterior. There is no need to protect the path between the end flange 22 and the body 2 since this lies inside the inner seal 72 and can only be reached from the interior of the automatic selector mechanism into which the operating shaft projects.

What we claim and desire to secure by Letters Patent is:

1. A switch assembly comprising a support mounted for rotary movement about a predetermined axis, electrical contact means carried by said support for movement therewith, fixed contact means positioned in relation to said rotatable support and said movable contact means carried thereby for engagement with predetermined of said movable contact means as said support is rotated about said axis, resilient means acting on one of said means for producing a force parallel to said axis and providing thereby contact pressure between said fixed and movable contact means and additional means cooperating with said movable contact means, comprising a plurality of resilient arms extending outwardly from the rotary support, for substantially at all times ensuring spatial, contact-free movement of contacts on the ends of said arms in an air gap during their sojourn toward and until engagement with said fixed contact means, said additional means comprising and abutment on which said resilient arms bear until said contacts of said movable contact means engage said fixed contact means, said fixed contact means being positioned at a level for engagement by said contacts of said movable contact means and being adapted for lifting, in consequence of said engagement, said movable contact means above the level of said abutment.

2. A switch assembly according to claim 1 wherein said fixed contact means comprise fixed contact elements arranged at spaced arcuate intervals and at pre-

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determined radial distances from said support, said additional means comprising an arcuate track on which said movable contact means bear in a region thereof radially inwardly of said terminal portion of said movable contact means adapted to engage said fixed contact means.

3. A switch assembly according to claim 1, wherein said resilient means is a coil spring bearing on an inner annular region on one side of the movable contact means to urge said movable contact means axially towards the fixed contact means, said additional means comprising an inner support for the movable contact means and being disposed on the opposite side of the movable contact means and extending along an annular region radially outward of said inner region and remote from said fixed contact means.

4. A switch assembly according to claim 3, wherein the groups of fixed contact means terminate in contact elements disposed at a common radial distance from the rotary support.

5. A switch assembly according to claim 1, wherein said movable contact means comprise a plurality of radially extending arms operatively connected to the rotary support, groups of said arms being electrically insulated from one another, said fixed contact means also being provided as groups for cooperation with said groups of arms.

6. In a vehicle automatic gear selector mechanism having a rotary shaft displaceable in conjunction with a selector lever of the mechanism, the improvement consisting of a switch assembly operatively connected to said shaft to be rotatable therewith, said switch assembly comprising a support operatively connected to said shaft for rotation thereby, movable contact means carried by said support, at least two fixed contact elements adapted for connection in an engine starting circuit for the vehicle, said fixed contact elements being

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positioned for engagement by said contact means at a plurality of predetermined angular positions of the rotary shaft. resilient means acting on the movable contact means for producing a force parallel to the shaft providing contact pressure between the movable contact means and the fixed contact means, and support means engageable by the movable contact means to hold a terminal contact portion of the movable contact means in an air gap when out of engagement with the fixed contact elements, said movable contact means comprising a plurality of resilient arms extending outwardly from said rotary shaft, said support means comprising an abutment on which said resilient arms bear until contacts on said terminal portion of said movable contact means engage said fixed contact means, said fixed contact means being positioned at a level for engagement by said contacts of said movable contact means and being adapted for lifting, in consequence of such engagement, said movable contact means above the level of said abutment.

7. In the assembly according to claim 6, including at least two further fixed contact elements associated with a reversing light circuit of the vehicle, said movable contact means including a group of contact arms terminating in contacts engageable with said fixed contact elements when the rotary shaft is placed in a reversed gear selection of the mechanism, thereby to permit operation of the reversing light.

8. In the switch assembly according to claim 6, including supplementary contact means of an electrical circuit associated with passenger safety restraint means, said supplementary contact means comprising a fixed part and a part displaceable with said rotary shaft to render said circuit operative at selected settings of the lever.

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